# Mercury's Global Topography from Radar Ranging Data

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# Introduction

- When Mercury's radius is expanded in Legendre functions to the second degree and order, the systematic error in radar ranging data is reduced substantially [1]. Previously, data spanning an observing interval from 1966 to 1990 were used to infer an equatorial ellipticity $(a - b)/a = (540 \pm 54) \times 10^{-6}$ and a center-of-figure minus center-of-mass offset of $(640 \pm 78)$ m. The magnitude of this equatorial center of figure offset implies an excess crustal thickness of 12 km or less, comparable to the Moon's excess. By comparing the equatorial ellipticity with the Mariner 10 gravity field [2], and assuming Airy isostatic compensation, bounds on crustal thickness can be derived. Mercury's crustal thickness is in the range from 100 to 300 km

# New Results

- The Mercury radar ranging observing interval has been extended from 1966 to the present. In addition, improvements in data reduction techniques have resulted in a set of Mercury ranging data less affected by systematic error, in particular the biases introduced by local topographic variations. We use this new set of reduced ranging data to improve Mercury's global topography and center-of-figure minus center-of-mass offset. New results on crustal thickness can be derived, and prospects for further improvement with Mercury Orbiter data are possible.
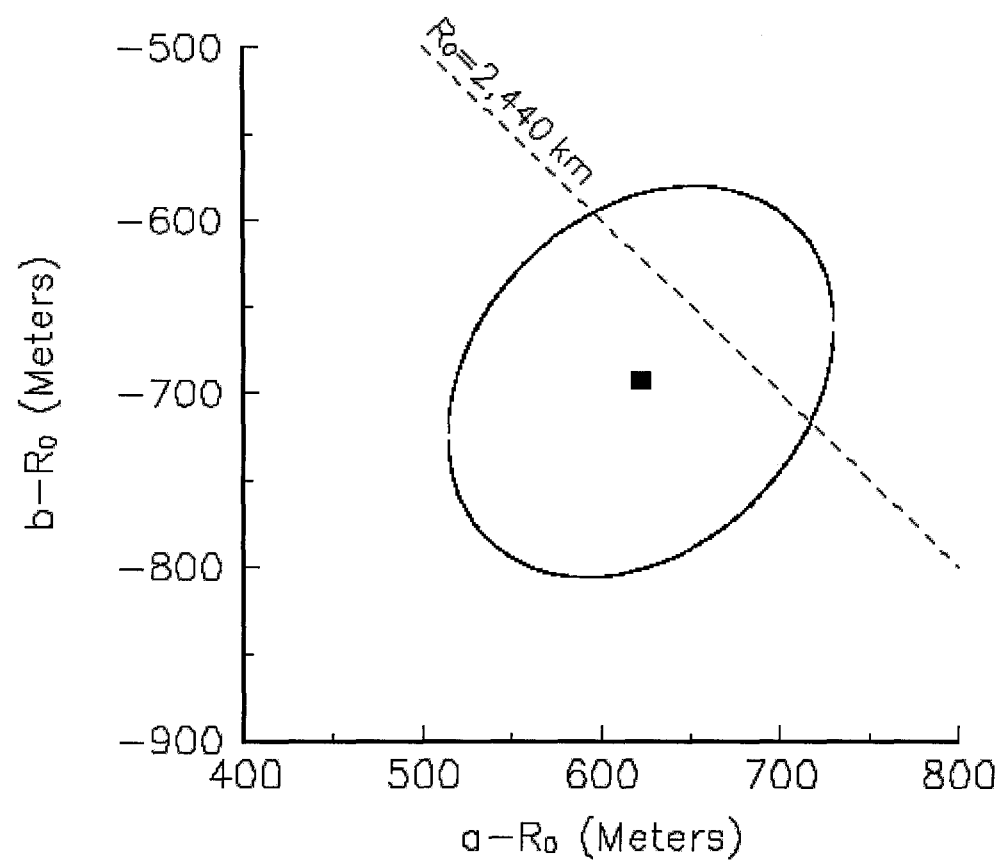
# References

- [1] Anderson, J. D. et al. (1996) *Icarus, 124,* 690-697. [2] Anderson, J. D. et al. (1987) *Icarus, 71,* 337-349.
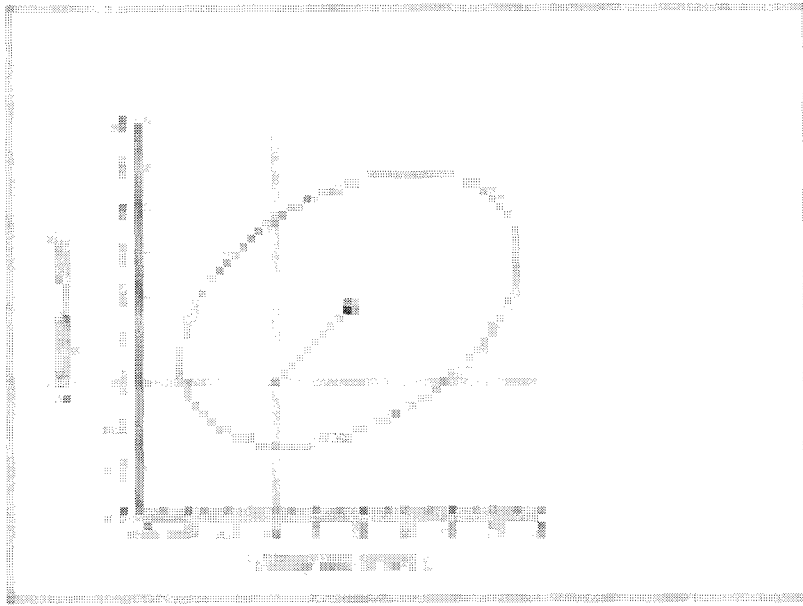
# Principal Axes a and b
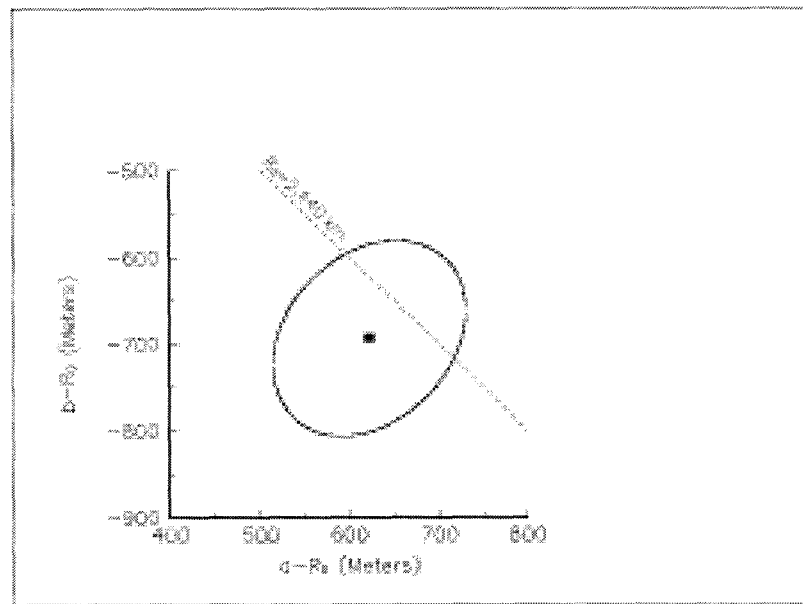


- One-sigma error ellipse for the principal axes a and b. The best-fit deviations from the reference radius $R_0$ are indicated by the solid square in the center of the error ellipse. The dashed line represents values of a and b for which their mean is equal to the the reference radius of 2440 km.

# Mercury Pole Location



One-sigma error ellipse for the
location of Mercury's pole. The
IAU reference pole normal to
Mercury's orbital plane is at the
origin of the dashed axes. The
best-fit location of the pole is
indicated by the solid square.